



PRELIMINARY ASSESSMENT

**CES Environmental Services
Houston, Harris County, Texas
TXD008950461**



REGION 6

**Prepared in cooperation with the
U.S. Environmental Protection Agency**

January 2015

PRELIMINARY ASSESSMENT

CES Environmental Services
4904 Griggs Road
Houston, Harris County, Texas
EPA ID TXDoo8950461

SIGNATURE PAGE




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1 INTRODUCTION

The Texas Commission on Environmental Quality (TCEQ) was tasked by the United States Environmental Protection Agency (EPA) Region 6 to conduct a Preliminary Assessment (PA) at the CES Environmental Services site in Houston, Harris County, Texas. The specific goals for the PA are:

- Determine the potential threat to public health or the environment posed by the site;
- Determine the potential for a release of hazardous constituents into the environment; and
- Determine the potential for placement of the site on the National Priorities List (Ref. 1).

Completion of the PA was consistent with EPA guidance for performing preliminary assessments under CERCLA and included reviewing existing site information, collecting receptor information within the range of site influence, determining regional geology, ground water, surface water, determining surrounding population characteristics, and conducting on- and off-site reconnaissance. This document includes a discussion of background site information (Section 2), a discussion of migration/exposure pathways and potential receptors (Section 3), and a list of pertinent references (Section 4) (Ref. 1; Ref. 2; Ref. 3).

2 SITE INFORMATION

2.1 SITE LOCATION

Site Name: CES Environmental Services
CERCLIS ID No.: TXD008950461
Location: 4904 Griggs Rd.
Houston, Harris County, Texas, 77021
Latitude: 29.69993°N
Longitude: 95.3429°W
Legal Description: TRS 7A 7B 7C 9A 10A 11C 12A 19 22 & 23
ABST 1020 WCRR CO SEC 2
Congressional District: 18

2.2 SITE DESCRIPTION

CES Environmental Services (CES) is listed in the EPA Envirofacts database as providing general freight trucking, nonhazardous waste treatment and disposal, miscellaneous waste management services, and remediation services (Ref. 14, p. 2). The CES site consists of three adjacent properties with a total area of 7.9 acres (Ref. 4, pp. 1, 3, 5). The site is located in a mixed commercial and residential area near the intersection of Griggs Road and Wayland Street in Houston, Harris County, Texas (Figures 1 and 2). Buildings currently present at the site and formerly used in business operations include a business office, a training center/locker room, the main processing facility, the tank wash office, a shed, and a warehouse. The main processing facility is a metal building that consists of a combined wastewater treatment system located in the north end, and a former laboratory and drum/container receiving area located in the south end. The former tank wash office is located in a separate metal building south of the main processing facility. Wastes are staged throughout the site in a myriad of vessels, including vacuum boxes, roll-off boxes, frac tanks, tanker trailers, totes, vats, drums, aboveground storage tanks, and other miscellaneous smaller containers (Ref. 5, pp. 6, 8,

10, 12, 14; Ref. 6, pp. 6, 7, 9, 11-28). Ponded storm water has been observed in the southwest corner and north end of the site in multiple TCEQ site visits (Ref. 6, pp. 3, 8, 15, 21; Ref. 7, pp. 2-4, 6, 7, 9, 10, 12, 17, 22, 25). Operations at the facility ceased in 2010 due to bankruptcy liquidation, and the site is currently inactive (Ref. 8, p. 1; Ref. 9, p. 1).

The properties located immediately east and south of the site are residences (Figure 3). A few of the residences bordering the northeast corner of the site are currently abandoned (Ref. 5, p. 16). Griggs Road borders the site to the north, and other residences are present on the north side of the road. A vacant, open lot is located on the west side of Wayland Street, north of the on-site warehouse. The Beatrice Mayes Institute Charter School is located northwest of the on-site warehouse, adjacent to the vacant lot (Figure 3). The school uses the property located southwest of the on-site warehouse for physical education activities (Ref. 5, p. 2). This property is not currently considered part of the CES site; however, according to historical aerial photos, it appears to have been used for business operations associated with the site beginning at some point after 1943 and continuing until as recently as 2007 (Ref. 10, pp. 1-6).

2.3 OWNERSHIP HISTORY

Prior to commercial development in the early 1940s, the properties associated with the site were used as agricultural land (Ref. 49, p. 14). In the early 1940s, the Younger family used the site for their business to sell horses to the United States Army. Their business grew into transportation by livestock-drawn flatbed trailers, which later became a flatbed trucking business (Ref. 49, p. 20). The oldest building still located on-site, the warehouse on Wayland Street, dates to 1977 (Ref. 10, p. 2). Younger Transportation owned the 4904 Griggs Road property from 1984 to 1988, and was merged into Younger Brothers Inc. in 1986. Between 1988 and 1998 the property was owned by Younger Brothers Inc., which used it for tank truck dispatch, cleaning, fueling, and storage and maintenance (Ref. 4, p. 7; Ref. 49, p. 5). In 1998 the property was sold to Suttles Truck Leasing Inc., a freight shipping and trucking company that accommodated hazardous material and hazardous waste transport needs. Dana

Transport Inc. acquired Suttles Truck Leasing Inc., in 2000 (Ref. 4, p. 7; Ref. 12, p. 12; Ref. 50, p. 1).

CES acquired the property at 4904 Griggs Road on June 11, 2002, and operated as a domestic for-profit corporation (Ref. 4, p. 7; Ref. 11, p. 1). The properties located at 4904 Griggs Road, 4900 Griggs Road and 5910 Wayland Street are currently owned by CES, with Matt Bowman as the registered agent (Ref. 4, pp. 1, 3, 5). On August 13, 2010, the company filed for bankruptcy and David Askanase was appointed as the Bankruptcy Trustee. He began assessment and disposal of many of the wastes left at the property (Ref. 8, p. 1; Ref. 29, p. 8).

2.4 OPERATIONS AND WASTE CHARACTERISTICS

Younger Brothers Inc. used tank truck trailers to haul a variety of petrochemicals. Products stored or used at the property between 1984 and 1998 include sodium hydroxide, inorganic acid, sulfuric acid, caustic tank cleaner, and diesel fuel (Ref. 4, p. 7; Ref. 49, p. 5). Truck washing sludge was disposed at the property in an onsite landfill for disposal of Class III inert waste materials. The landfill is no longer present at the site but its previous location may have coincided with the portion of the Kuhlman/Belmont Gully that once flowed through the property (Ref. 49, p. 7, 20).

CES began operating at the site in 2002 as a tank truck cleaning facility and a combined waste treatment facility. The facility cleaned approximately 3,000 truck trailers, roll-off boxes, totes, and other types of transportation equipment each year. CES removed and managed petroleum products, paint thinners, acids, and caustic soda solutions from the containers (Ref. 29, pp. 3-4). Other services at the facility included used oil recycling, waste transportation, waste packaging, and waste disposal. The company managed hazardous industrial wastes and wastewater, and was registered as a solid waste generator, receiver, transporter, and transfer facility (Ref. 29, p. 4).

CES has an industrial waste permit, TCEQ IHW Permit No. 39048, as well as a permit to pre-treat wastewater, Permit No. TXR05T850 (Ref. 29, p. 4). Wastewater discharged by the facility was handled by the City of Houston through the Industrial Waste Permit Nos. 6806 and 9558. Permit No. 6806 was terminated in October 2009 after the company discharged hazardous waste in violation of this permit into the City of Houston sanitary sewer system (Ref. 29, p. 4; Ref. 30, p. 1). This discharge reportedly destroyed the City of Houston's ability to treat waste at the Sims Bayou wastewater treatment facility, and caused a release of phenolic compounds into Sims Bayou (Ref. 32, p. 1; Ref. 31, pp 1-2). The company also registered for air permit-by-rule (PBR) 83191 to handle and recover methylene chloride, as well as PBR 83798 to authorize an oil quality improvement operation that treated oil to remove water and other impurities (Ref. 34, p. 2; Ref. 33, p. 2).

Other operations at the facility included recycling of methyl ethyl ketone (MEK) wastes. Mixtures of either methanol, non-volatile polymer solids and water, or MEK and water entered the facility through tank trucks and were pumped into the recycle distillation system for processing. Water from the distillation process was sent to the on-site wastewater treatment facility (Ref. 35, p. 3). On December 6, 2008, an explosion occurred at the site due to CES's attempt to combust MEK vapors or liquids in the thermal oxidizer. The event released 239 pounds of MEK to the atmosphere in 13 minutes, exceeding the rate of 1.8 pounds per hour, calculated as the maximum authorized rate in 30 Texas Administrative Code §106.262. On July 7, 2009, another explosion occurred during the opening of a hatch on a tanker truck, and resulted in the release of 36.87 pounds of methanol and ethanol (Ref. 29, pp. 37-39).

During a site visit in March 2009, TCEQ investigators noted that a 20,000 gallon tank used by CES to store incoming wastewater had no secondary containment. The wastewater constituted characteristically hazardous waste due to benzene toxicity. The investigators also noticed eleven 300-gallon totes, four "first flush" totes in wash bays, and four 55-gallon drums, all containing hazardous wastes. In addition, two tanker

trucks (Nos. 7253 and 221) containing characteristically hazardous waste due to methanol toxicity were observed (Ref. 29, pp. 36-37).

Between March 2005 and March 2009, the TCEQ documented at least 20 environmental violations that resulted in enforcement actions. These violations included failure to maintain records, storage of non-permitted hazardous wastewater, operation of tanks without secondary containment, failure to conduct required tests and inspections, and failure to label hazardous waste containers (Ref. 13, pp. 1-2). Since 2009 there have been two formal enforcement actions and two informal enforcement actions associated with the site. During the last facility inspection in April 2010, 15 RCRA violations were documented (Ref. 9, p. 4).

2.5 PREVIOUS INVESTIGATIONS

In May 2009, soil and ground water samples were collected approximately two blocks east of the CES facility as part of a Limited Phase II Environmental Site Assessment that was conducted at 4922 Griggs Road (Ref. 36, p. 3, 9). Ground water samples collected at a depth of 20-30 feet below ground surface from three borings at the property had concentrations of 1,2-dibromo-3-chloropropane, tetrachloroethene, trichloroethene, and 1,2-dichloroethane at levels exceeding their respective maximum contaminant levels (MCLs). Chloroform was also detected in one of these samples at a level exceeding the SCDM benchmark for cancer risk (Ref. 36, pp. 5, 14-15; Ref. 52, pp. 10, 12, 13, 18, 19). Soil samples collected at a depth of 2-5 feet had concentrations of arsenic at levels exceeding the SCDM soil pathway benchmark for cancer risk (Ref. 36, pp. 11-13; Ref. 52, p. 6). The assessment identified CES as a potential source of this contamination (Ref. 36, p. 6).

Soil samples were collected at the CES site on October 1, 2009, by the TCEQ Industrial and Hazardous Waste Section. Detected analytes included polycyclic aromatic hydrocarbons, metals, phthalates, and methylene chloride. Additionally, benzo(a)anthracene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, arsenic, and chromium

were detected at levels exceeding their respective SCDM soil pathway benchmarks (Ref. 37, pp. 8-55; Ref. 52, pp. 6-8, 11, 14).

In March 2014, vandals dumped the contents of two tanker trailers and seven roll-off boxes on the ground and into on-site containment structures in order to steal the equipment (Ref. 38, p. 1). An emergency action was conducted by the TCEQ Houston Regional Office in response. TCEQ personnel secured the entry gate, placed piles of contaminated debris on plastic sheeting with plastic covering, and used soil to build containment dikes around chemical containers and secondary containment structures (Ref. 39, p. 4).

On August 1, 2014, a release from an open valve on Tanker Trailer 408 occurred (Ref. 7, pp. 1, 6; Ref. 6, p. 12). Storm water runoff from the site carried the oily water mixture into the residential neighborhood southwest of the site on Kingsbury Street (Ref. 38, p. 1). The City of Houston and TCEQ Houston Regional Office conducted another emergency action in response, which consisted of removing the spilled material from storm sewers, flushing the storm sewers, removing the oily material from ponded areas on the site, repairing soil containment structures, and placing a containment structure to prevent offsite drainage from the facility. The EPA repaired the security fencing around the site, and sampled soil in the drainage ditch, storm water, air, and the contents of Tanker Trailer 408 (Ref. 39, p. 4; Ref. 7, p. 6). Storm water samples collected in a vegetated drainage ditch along the surface water pathway located next to Wayland Street, between Keystone Street and Dewberry Street, indicated detections of acetone, MEK, metals, pesticides, 1-methylnaphthalene, 2-methylnaphthalene, and phenolic compounds. Aluminum, lead, nickel, selenium, and alpha-chlordane were detected at levels exceeding the SCDM surface water pathway environmental benchmark for acute freshwater exposure (Ref. 42, pp. 1-19; Ref. 47, p. 1; Ref. 52, pp. 5, 9, 15-17).

The EPA began a response action in August 2014 to sample the on-site containers and dispose of the chemicals which are considered to pose a threat to public health and welfare. This ongoing removal action will include the clean-up and disposal of all

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containers and visually contaminated asphalt, concrete, soil and debris. The EPA also plans to dewater the pooled areas of the site and remove contaminated sediment. Samples collected in September 2014 from the ponded storm water at the site indicated detections of acetone, arsenic, manganese, lead and 4-methyl-2-pentanone. Aluminum, lead and nickel were detected at levels exceeding the SCDM surface water pathway environmental benchmark for acute freshwater exposure (Ref. 42, pp. 20-61; Ref. 52, pp. 5, 15, 16). Contaminated storm water will be discharged into the City of Houston's sanitary sewer to reduce runoff into the storm drains (Ref. 38, p. 2). The Trustee continues to address waste issues at the site in coordination with the TCEQ and EPA (Ref. 38, p. 1).

2.6 SITE VISIT

On September 24, 2014, TCEQ Superfund Section staff visited the site and adjacent residential neighborhoods. The earthen berm constructed by the City of Houston to prevent storm water runoff from the site to Kingsbury Street was still in place (Ref. 5, p. 4; Ref. 6, pp. 3, 17). There was also an eroding earthen berm present on the northeast side of the site to prevent surface water runoff into the residential properties on the east side of the site. During large flood events, storm water may flow over the berm and into residential backyards located along the eastern fence of the site. TCEQ staff also observed several egrets and killdeer wading in the ponded surface water on the southwest and north ends of the site (Ref. 5, p. 12; Ref. 6, p. 21).

TCEQ staff observed evidence of vandalism throughout the site. A former tanker trailer reportedly cut apart by vandals was located near the former wastewater treatment system inside the main processing facility. Black oil formerly contained within this tanker trailer was dumped in the loading bay of the building. During the site visit, an uncovered vat containing this oil was observed in the main processing facility. TCEQ staff also observed a trash dumping area in front of the warehouse located on the west side of Wayland Street (Ref. 5, p. 14; Ref. 6, pp. 23-25).

2.7 SOURCES

Potential sources associated with the site include various chemicals contained within aboveground storage tanks, vats, totes, drums, frac tanks, roll-off boxes, vacuum boxes, tanker trailers, wastewater treatment tanks, and laboratory sampling containers. Contaminated soils, asphalt, and concrete are also potential sources (Figure 2).

2.7.1 Source 1: Aboveground Storage Tanks

As of December 2014, 22 aboveground storage tanks (ASTs), each with an estimated storage capacity between 16,000 and 20,000 gallons, were located at the site (Ref. 38, p. 1; Ref. 45, p. 1). These ASTs are classified into two groups referenced as the North ASTs and the South ASTs (Figure 2). Both AST groups are surrounded by concrete secondary containment; however, the concrete containment structure does not entirely surround the ASTs. In places where concrete walls are missing, earthen berms have been constructed to prevent releases from the containment structure (Ref. 7, p. 12). At the time of the TCEQ site visit in September 2014, a black oily sludge material was observed within the secondary containment of the South ASTs. This material appeared to be leaking from the earthen portion of the containment wall (Ref. 6, pp. 14, 16).

Samples collected from the ASTs in September 2014 indicated detections of sulfide, benzene, MEK and phenolic compounds, as well as other volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs) (Ref. 48, pp. 6-42). The contents of three of these ASTs have been disposed as part of the ongoing EPA removal action (Ref. 38, p. 1).

2.7.2 Source 2: Vats, Totes and Drums

Four vats containing oily material are located on-site (Ref. 46, p. 20). During the September 2014 site visit, TCEQ staff observed an uncovered vat inside the main processing facility that contained black oil previously recovered from the loading bay located inside the building. Vandals reportedly cut apart a tanker trailer containing this

material and dumped the oil in the loading bay (Ref. 5, p. 14; Ref. 6, pp. 23-24). Several plastic and metal totes and drums were also scattered throughout the facility, many of them rusted, smashed, corroded, bulging, or in poor condition. Many of these containers were empty but some contained unidentified materials. TCEQ staff observed the contents of some of the drums and totes spilling onto the ground, while others had stained concrete or soil beneath them (Ref. 5, pp. 10, 12, 14, 16; Ref. 6, pp. 12-16, 19-28). Several of the totes were stacked primarily on the concrete pad south of the South ASTs (Ref. 5, p. 10; Figure 2).

The inventory conducted by the Bankruptcy Trustee in October 2010 identified approximately 450 55-gallon drums containing acetone, sump sludge, spent caustic material, sulfuric acid, spent carbon, residue oil, antifreeze, and ferric chloride. Approximately 100 totes, each with a 300 gallon capacity, were also identified. They contained oily water, spent caustic, sludge, sodium hydroxide, non-hazardous paint, diesel, and ferric chloride (Ref. 45, pp. 1-7).

2.7.3 Source 3: Frac Tanks, Vacuum Boxes and Roll-off Boxes

As of December 2014, there were 12 frac tanks located at the site, each with a 20,000 gallon capacity (Ref. 45, pp. 1-7). One frac tank sampled in 2011 contained hazardous levels of benzene, o-cresol, cresol, and 2,4,6-trichlorophenol. The other tanks contained nonhazardous oily water (Ref. 39, pp. 19-22). Samples collected from these tanks in August 2014 indicated detections of metals, MEK, acetone, naphthalene, benzene, phenolic compounds, pesticides, herbicides, and several other SVOCs (Ref. 48, pp. 49-72, 100-133). Three of the frac tanks have been disposed as part of the ongoing EPA removal action (Ref. 38, p. 1).

On September 24, 2014, TCEQ staff observed evidence of corrosion and extensive red staining on one of the roll-off boxes caused by an unidentified leaking substance (Ref. 5, p. 12; Ref. 6, pp. 19-20). Some vacuum boxes on site contained hazardous phenolic caustic substances with strong odors, while others contained oily water and oily sludge

with detections of benzene (Ref. 39 pp. 31-50). All but two of these vacuum boxes have been removed and disposed (Ref. 38, p. 1). These vacuum boxes were located approximately five feet east of the fence that borders the western portion of the site (Figure 2). The Beatrice Mayes Institute Charter School uses the property west of this fence for physical education activities (Ref. 5, p. 2).

2.7.4 Source 4: Tanker Trailers 407 and 408

Tanker Trailers 407 and 408, each with a 5,000 gallon storage capacity, contained oily water with solids (Ref. 45, p. 6; Ref. 46, p. 15). Samples collected from these trailers in August 2014 indicated detections of acetone, MEK, naphthalene, ethylbenzene, toluene, xylene, phenanthrene, dioxins, and phenolic compounds, as well as other VOCs and SVOCs (Ref. 48, pp. 233-267). The contents of these tanker trailers have been disposed as part of the EPA removal action (Ref. 38, p. 1).

2.7.5 Source 5: Wastewater Treatment Tanks

There are currently 19 wastewater treatment tanks at the site, each with an estimated storage capacity of 10,000 gallons (Ref. 45, p. 4; Ref. 38, p. 1). The liquid waste within these containers consists of a mixture of oily material, acids, and water (Ref. 46, 22). Samples collected from these tanks in October 2014 indicated detections of acetone, benzene, chloroform, methylene chloride, MEK, phenolic compounds, naphthalene, carbon disulfide, and metals (Ref. 48, pp. 134-216).

2.7.6 Source 6: Laboratory Containers, Chemical Products and Waste Piles

TCEQ staff observed a wide variety of sampling containers, many containing unknown chemicals, within the former laboratory of the main processing facility during the September 2014 site visit (Ref. 6, p. 21). The Bankruptcy Trustee consolidated and disposed of the chemicals within these containers, as well as many of the old chemical

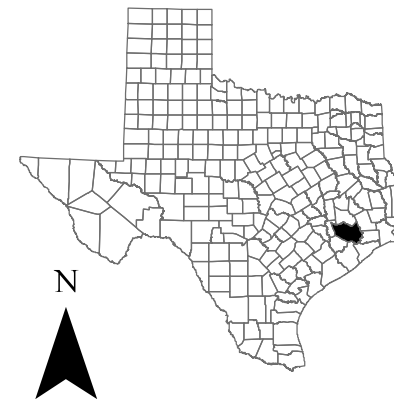
products stored in the warehouse on Wayland Street. Debris from stolen roll-off boxes was also removed and disposed of by the Trustee (Ref. 38, p. 1).



Figure 1: Site Location Map

CES Environmental Services

4904 Griggs Road
Houston, Harris
County, Texas



The base map is a Collarless 24 K Digital Raster Graphic. Coordinate System: NAD 1983 UTM Zone 15N. This map was generated by the Remediation Division of the Texas Commission on Environmental Quality. It is intended for illustrative or informational purposes only, and is not suitable for legal, engineering, or survey purposes. This map does not represent an on-the-ground survey conducted by or under the supervision of a registered professional land surveyor. In cases where property boundaries are shown, it only represents their approximate relative location. No claims are made to the accuracy or completeness of the data or to its suitability for a particular use. For more information concerning this map, contact the Remediation Division at 800-633-9363. Map created by Adrienne Love in September 2014.

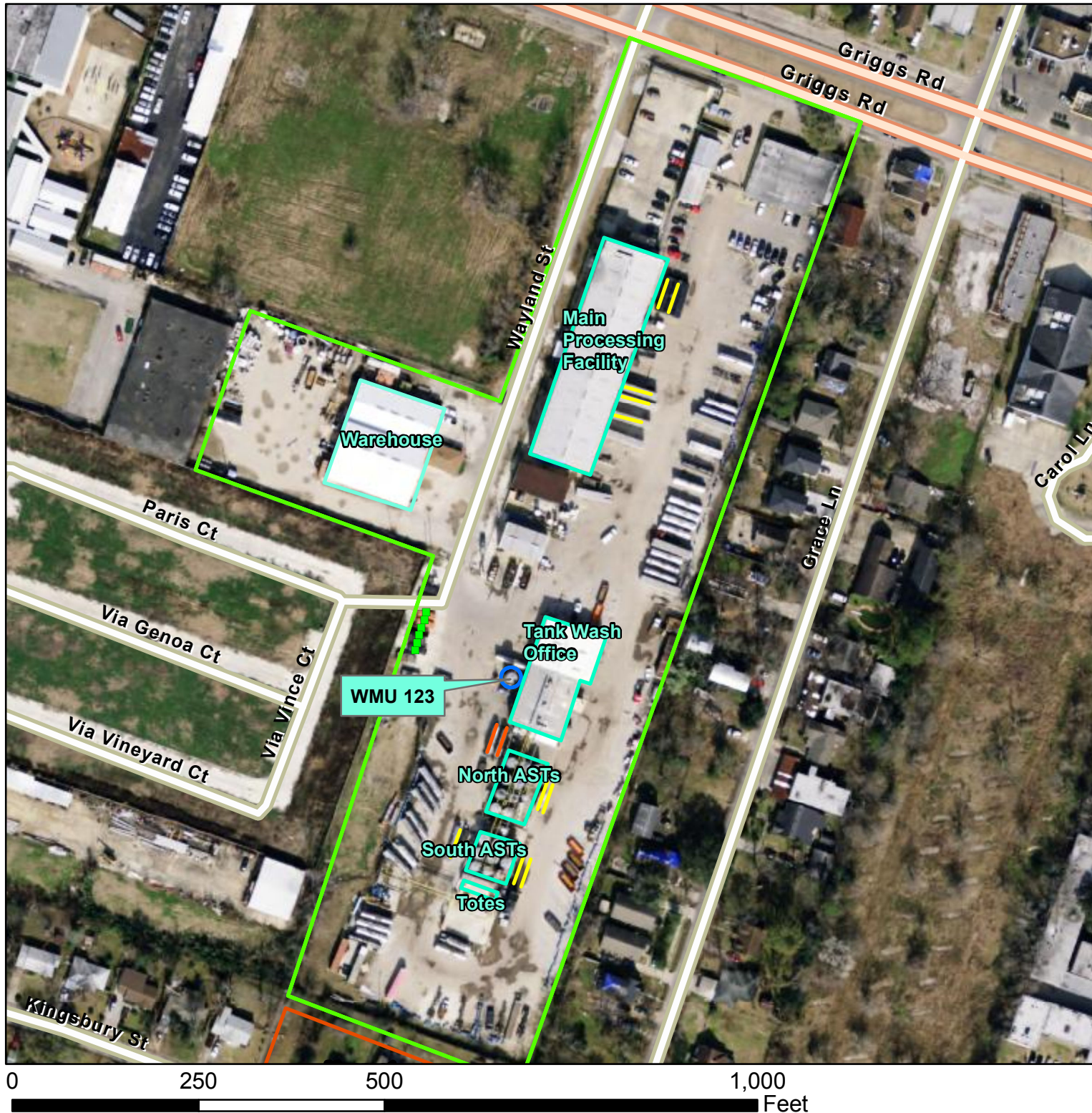
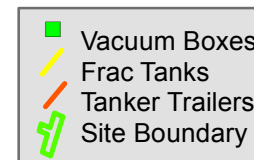
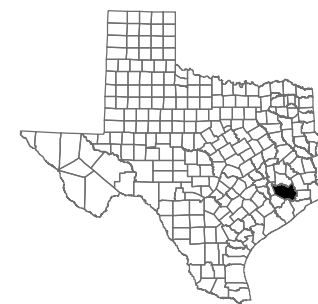


Figure 2: Site Features Map

CES Environmental Services

4904 Griggs Road
Houston, Harris
County, Texas



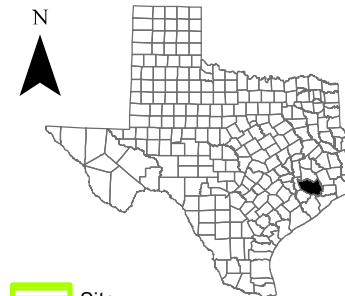
The base map is 2010 ArcGIS Imagery from the City of Houston. Coordinate System: NAD 1983 UTM Zone 15N. This map was generated by the Remediation Division of the Texas Commission on Environmental Quality. It is intended for illustrative or informational purposes only, and is not suitable for legal, engineering, or survey purposes. This map does not represent an on-the-ground survey conducted by or under the supervision of a registered professional land surveyor. In cases where property boundaries are shown, it only represents their approximate relative location. No claims are made to the accuracy or completeness of the data or to its suitability for a particular use. For more information concerning this map, contact the Remediation Division at 800-633-9363. Map created by Adrienne Love in October 2014.



Figure 3: Site Proximity Features Map

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4904 Griggs Road
Houston, Harris
County, Texas



- Site
- Nearest Residences
- Formerly owned by CES
- Schools
- Churches

The base map is NAIP 2012 Digital Imagery. Coordinate System: NAD 1983 UTM Zone 15N. This map was generated by the Remediation Division of the Texas Commission on Environmental Quality. It is intended for illustrative or informational purposes only, and is not suitable for legal, engineering, or survey purposes. This map does not represent an on-the-ground survey conducted by or under the supervision of a registered professional land surveyor. In cases where property boundaries are shown, it only represents their approximate relative location. No claims are made to the accuracy or completeness of the data or to its suitability for a particular use. For more information concerning this map, contact the Remediation Division at 800-633-9363. Map created by Adrienne Love in October 2014.

0 0.25 0.5 1 Miles

3 MIGRATION/EXPOSURE PATHWAYS

The following sections describe migration/exposure pathways and potential receptors within the site's range of influence.

3.1 GROUND WATER MIGRATION PATHWAY

The target distance limit (TDL) for the ground water migration pathway is a 4-mile radius that extends from the sources at the site. Figure 4 depicts the ground water 4-mile TDL.

3.1.1 Geologic Setting

The geologic formations and hydrostratigraphic units found beneath the site, beginning at the surface and progressing downward, are shown in Table 3.1.

Table 3-1 Stratigraphic and Hydrogeologic Framework of the site

System	Series	Stratigraphic Units		Thickness ** (feet)	Hydrostrati- graphic Units	Thickness ** (feet)
Quaternary	Holocene	Alluvium*		-	Chicot aquifer	700
	Pleistocene	Beaumont Clay		200		
		Lissie Formation	Montgomery Formation	125		
			Bentley Formation	125		
		Willis Sand		250		
Tertiary	Pliocene	Goliad Sand		200	Evangeline aquifer	1300
	Miocene	Fleming Formation		2400	Burkeville confining unit	300
					Jasper aquifer	1000
	Oligocene	Catahoula Sandstone		900	Catahoula confining unit	900

(Modified from Baker, 1979)

*not present at site

** (Ref. 17, pp. 10-15)

The Pleistocene Series consists of Beaumont Clay, Lissie Formation, Montgomery Formation, Bentley Formation, and Willis Sand (Table 3-1). The Beaumont Clay is the youngest formation of the Pleistocene age that crops out extensively in Harris County. The Beaumont Clay is made up of poorly bedded marly clay that is interbedded with sand lenses (Ref. 17, p. 16, 17).

The Lissie Formation underlies the Beaumont Formation. The Lissie Formation is considered equivalent in age to the Montgomery and the Bentley Formations, with the bottom of the latter being considered the base of the Pleistocene. The Lissie Formation consists of reddish, orange, and gray fine- to coarse-grained, cross-bedded sands. Caliche beds, containing finer-grained cemented sands, are often found at the base of the Lissie Formation (Ref. 17, pp. 10, 16).

The Willis Sand underlies the Lissie Formation and overlies the Goliad Formation. The Willis Sand consists of reddish, gravelly sands with subordinate clays that grade into the Goliad Formation toward the southwest of the Gulf Coast (Ref. 17, pp. 16).

The Pliocene Series consists of the Goliad Formation which overlies the Miocene Fleming Formation. The upper part of the Goliad Formation consists of sands with caliche cement. The Goliad Formation also consists of coarse-grained sediments, including cobbles, clay balls, and wood fragments. The sands in the Goliad Formation are typically whitish-or pinkish-gray interbedded with grayish clays (Ref. 17, pp. 14, 16).

The average annual precipitation in the city of Houston, Texas is approximately 50 inches (Ref. 19, p. 1).

3.1.2 Aquifer System

The site overlies the Gulf Coast aquifer, which consists of five hydro-stratigraphic units, from youngest to oldest: the Chicot aquifer, the Evangeline aquifer, the Burkeville confining system, the Jasper aquifer, and the Catahoula confining system (Table 3-1).

The Chicot and Evangeline aquifers flow toward the Gulf of Mexico (Ref. 17, pp. 19-21). The recharge of aquifers mainly occurs through the outcrop of the Chicot aquifer (about 140,000 acre-feet per year); smaller quantities recharge through the Evangeline (about 49,000 acre-feet per year) and the Jasper aquifers (about 33,000 acre-feet per year); and negligible quantities recharge through the Burkeville confining system (Ref. 17, p. 36).

The Chicot aquifer includes the Beaumont Clay which extends from the ground surface through the Willis Sand. Due to the high percentage of sand in the aquifer formations, the Chicot aquifer is recognized for an abundance of water in Southeast Texas. The depth of the base of the Chicot aquifer is approximately 700 feet below the ground surface (bgs) in the site area (Ref. 17, pp. 2, 22-33).

The Evangeline aquifer is approximately 1,300 feet thick and underlies the Chicot aquifer, spanning the entire thickness of the Pliocene Goliad Formation sands and part of the Miocene Flemming Formation (Ref. 17, pp. 3-10). The Chicot and Evangeline aquifers are geologically similar; however differences in hydraulic conductivity form the basis for distinction (Ref. 20, p. 10). The Evangeline aquifer is considered to be one of the most prolific aquifers of the Coastal Plain, yielding large quantities of good quality ground water. In the site area, the Evangeline aquifer extends from approximately 700 feet bgs to approximately 2,000 feet bgs (Ref. 17, pp. 10-15, 22, 33, 38).

The Evangeline aquifer and the underlying Jasper aquifer are separated by the Burkeville confining system, which consists of 300 feet of silt and clay strata. The Jasper aquifer is the deepest confined water bearing unit in the Gulf Coast aquifer system in Texas, and consists of the Fleming Formation and the Oakville Sandstone. The base of the Jasper aquifer is approximately 3,300 feet bgs in the site area (Ref. 17, pp. 3-11, 15).

The Catahoula confining system underlies the Jasper aquifer and has an average thickness of 900 feet. The Catahoula Formation is composed of non-marine sands, clays, and volcano-clastic deposits interbedded with fluvial sediments (Ref. 17, pp. 11-18).

During most of the 20th century, the high rate of ground water removal from the Chicot and Evangeline aquifers in Harris County and surrounding counties caused water levels to dramatically fall in these aquifers. This problem caused land-surface subsidence problems and led to the use of surface water as the primary source of potable water in the area. In the mid-1970s, the City of Houston converted most of its public water system (PWS) water sources to surface water from Lake Houston, and the San Jacinto and Trinity rivers (Ref. 17, pp. 33-35).

3.1.3 Drinking Water Receptors

The site is located in a neighborhood supplied by the City of Houston municipal water supply (MWS). Local lakes and rivers, including the Trinity River, Lake Livingston, San Jacinto River, Lake Conroe, and Lake Houston, supply the City of Houston surface water resources. Ground water wells drilled into the Evangeline and Chicot aquifers with an average depth of 750 feet provide 29 percent of the City's water supply to customers predominately located in the west side of Houston (Ref. 15, pp. 2-4). There are two active Public Water Supply (PWS) wells within four miles of the site; one serves the City of Houston (PWS #1010013), and the other serves the MD Anderson Cancer Center (PWS #1013142) (Ref. 16, pp. 1, 3).

There are 75 wells in the Texas Water Development Board (TWDB) Submitted Driller's Reports database within the 4-mile TDL, including 4 domestic, 5 irrigation, 5 industrial, 6 geothermal heat loop, 1 rig supply, and 54 test wells. Of these, one irrigation well and three test wells are located within two miles of the site (Ref. 18, pp. 1-5). The estimated population for Harris County in 2013 was 4,336,853 (Ref. 21, p. 1).

3.2 SURFACE WATER MIGRATION PATHWAY

The surface water migration pathway TDL begins at the probable point of entry (PPE) of surface water runoff from the site to a surface water body and extends downstream for 15 miles. Figure 5 depicts the surface water 15-mile TDL.

3.2.1 Overland Route

Prior to urban development, surface water drainage from the site flowed directly into the Kuhlman/Belmont Gully, which once flowed through the northern end of the site (Ref. 49, p. 16; Ref. 10, p. 1). Currently, a storm water drain on the northwest corner of the site at Wayland Street and Griggs Road receives surface water runoff from the northwest part of the property. During the TCEQ site visit on September 24, 2014, all ponded storm water was being pumped by the EPA to the northwest corner of the site to discharge into this drain. Earthen berms were constructed in 2014 to prevent storm water runoff from traveling into residential yards located northeast and southwest of the site. Before these berms were constructed, storm water from the southwest part of the site flowed south into a ditch, then west onto Kingsbury Street into a storm water drain on the corner of Kingsbury and Calhoun Street (Ref. 6, p. 2). Storm water from the northeast portion of the site likely traveled directly into residential backyards adjacent to the site, then into a storm water drain located on Grace Lane (Ref. 5, pp. 2, 4, 12; Ref. 44, p. 1).

All storm water drains associated with the site empty into the Kuhlman/Belmont Gully on the north side of Schroeder Road and Griggs Road (Ref. 44, p. 1). The United States Geological Survey topographic map indicates that the gully is intermittent; however, the TCEQ observed standing water in the gully in September 2014 (Figure 1; Ref. 6, p. 1). This is considered the probable point of entry for the surface water migration pathway. The Kuhlman/Belmont Gully empties into Brays Bayou, which then empties into Buffalo Bayou (Figure 5).

The 2-year, 24-hour rainfall average for the site area is 5 inches (Ref. 22, p. 3). The site is not in a Federal Emergency Management Agency (FEMA) designated flood zone (Ref. 23, p. 1).

3.2.2 Drinking Water Receptors

There are no surface water intakes downstream of the site within the 15-mile TDL (Ref. 51, p. 1). The average number of persons per household in Harris County is 2.88 (Ref. 21, p. 1).

3.2.3 Human Food Chain Receptors

It is likely that local Houston residents occasionally consume fish caught in the numerous parks along Brays Bayou prior to intersecting Buffalo Bayou, also referred to as the Houston Ship Channel; however, due to the presence of dioxins, organochlorine pesticides, and polychlorinated biphenyls, the Texas Department of State Health Services recommended adults limit consumption of all fish species and blue crabs from the Houston Ship Channel and its contiguous waters to no more than one, 8-ounce meal per month. The fish consumption advisory also recommended women of childbearing age and children under 12 not consume any fish or blue crabs from these waters (Ref. 24, p. 3). The portions of the TDL within Brays Bayou and Buffalo Bayou shown on Figure 5 are affected by this advisory.

3.2.4 Environmental Receptors

Endangered or threatened species located in Harris County include the following: Houston toad (*Anaxyrus houstonensis*), American Peregrine Falcon (*Falco peregrinus anatum*), Bald Eagle (*Haliaeetus leucocephalus*), Peregrine Falcon (*Falco peregrinus*), Red-cockaded Woodpecker (*Picoides borealis*), White-faced Ibis (*Plegadis chihi*), White-tailed Hawk (*Buteo albicaudatus*), Whooping Crane (*Grus americana*), Wood Stork (*Mycteria americana*), Creek chubsucker (*Erimyzon oblongus*), Smalltooth

sawfish (*Pristis pectinata*), Louisiana black bear (*Ursus americanus luteolus*), Rafinesque's big-eared bat (*Corynorhinus rafinesquii*), Red wolf (*Canis rufus*), Louisiana pigtoe (*Pleurobema riddellii*), Sandbank pocketbook (*Lampsilis satura*), Texas pigtoe (*Fusconaia askewi*), Alligator snapping turtle (*Macrochelys temminckii*), Green sea turtle (*Chelonia mydas*), Kemp's Ridley sea turtle (*Lepidochelys kempii*), Leatherback sea turtle (*Dermochelys coriacea*), Loggerhead sea turtle (*Caretta caretta*), Smooth green snake (*Liophorophis vernalis*), Texas horned lizard (*Phrynosoma cornutum*), Timber rattlesnake (*Crotalus horridus*), and Texas prairie dawn (*Hymenoxys texana*) (Ref. 25, pp. 1-6). There are two large HRS-eligible wetlands within the 15-mile TDL. One wetland segment, located along Brays Bayou, is 77.9 acres in size and is classified as a riverine lower perennial unconsolidated bottom wetland. The other wetland segment, located along the Houston Ship Channel, is 2,385.25 acres in size and is classified as an estuarine and marine deepwater subtidal unconsolidated bottom wetland (Ref. 26, pp. 1-4). There are no other sensitive environments identified within the surface water TDL (Figure 5).

3.3 SOIL EXPOSURE PATHWAY

The soil exposure pathway is evaluated based on the threat to resident and nearby populations from hazardous substances present within two feet of the surface.

3.3.1 Site Setting and Sources

The portion of the site east of Wayland Street is largely covered by impervious concrete and asphalt throughout the majority of the property (Ref. 6, p. 19). On-site soils are classified by the United States Department of Agriculture as a mix of urban land and the Bacliff-Urban land complex with little to no slope. Most soil in the area is either covered by structures and pavement or disturbed by cutting, filling, or grading. Native soils are the Bacliff clay in the immediate vicinity of the site and the Vamont clay along the Kuhlman/Belmont Gully (Ref. 53, pp. 1-3).

Extensive staining of the concrete, asphalt and soil at the site was observed by TCEQ staff in September 2014. The soil formerly underneath Vacuum Box 617 had bright orange-red and light blue stains. There was black soil staining beneath Vacuum Box 610, at the former location of Vacuum Box 601 and where the former aluminum shed was previously located, south of the main processing facility (Ref. 5, pp. 6, 8; Ref. 6, pp. 7-9, 25). Black staining was also observed on the concrete beneath Waste Management Unit 123, near Vacuum Box 406 and beneath an unidentified drum located on the eastern border of the site. Orange and black soil staining was observed on the property west of Wayland Street, near the western and southern fence lines, directly adjacent to the property used by the Beatrice Mayes Institute Charter School (Ref. 6, pp. 11, 19, 21, 26-27).

In addition to the soil staining, TCEQ staff also noticed oil seeping from the earthen berm located on the southwest side of the site, which was constructed in response to the August 2014 release to stop storm water runoff from entering the Kingsbury Street neighborhood (Ref. 5, p. 10; Ref. 6, p. 18). TCEQ staff observed red staining on the pavement along Kingsbury Street, likely caused by this release (Ref. 5, p. 4). All on-site and off-site observed contamination was located within 200 feet of the bordering residences or school (Figure 2). Soil samples collected from storm water ditches on Kingsbury Street in August 2014 indicated detections of acetone, carbon disulfide, MEK, alpha- and gamma-chlordane, metals, and other VOCs and SVOCs. Arsenic was detected at a concentration of 8.4 mg/kg, which exceeds the SCDM soil pathway cancer risk benchmark of 0.71 mg/kg (Ref. 47, pp. 1, 16-17, 22-23, 34, 36, 42-47, 56, 64-69, 85-86, 91-92, 103, 105, 114, 116, 125, 132-138; Ref. 52, p. 6).

A 24-hour security guard was present at the site between September 2010 and June 2013 in order to protect the public from hazardous material (Ref. 8, p. 2). Currently, there is a fence surrounding the entire property to prevent open access to the facility; however, vandals have previously compromised the security fencing by stealing fence panels, and the fence has not eliminated vandalism at the facility (Ref. 41, p. 1). Between

August and December 2014, two incidents occurred at the site, including theft of equipment batteries and vandalism of a fence (Ref. 38, p. 2).

3.3.2 Receptors

There are 17 residences located within 200 feet of sources at the site (Figure 3). The nearest school, the Beatrice Mayes Institute Charter School, is located approximately 200 feet northwest of the site, and includes 443 students (Figure 3; Ref. 27, p. 1). There are no day care facilities, sensitive terrestrial environments, or land resources within 200 feet of the site (Figure 3).

3.4 AIR MIGRATION PATHWAY

The air migration pathway TDL is a 4-mile radius that extends from sources at the site (Figure 4).

3.4.1 Air Pathway Receptors

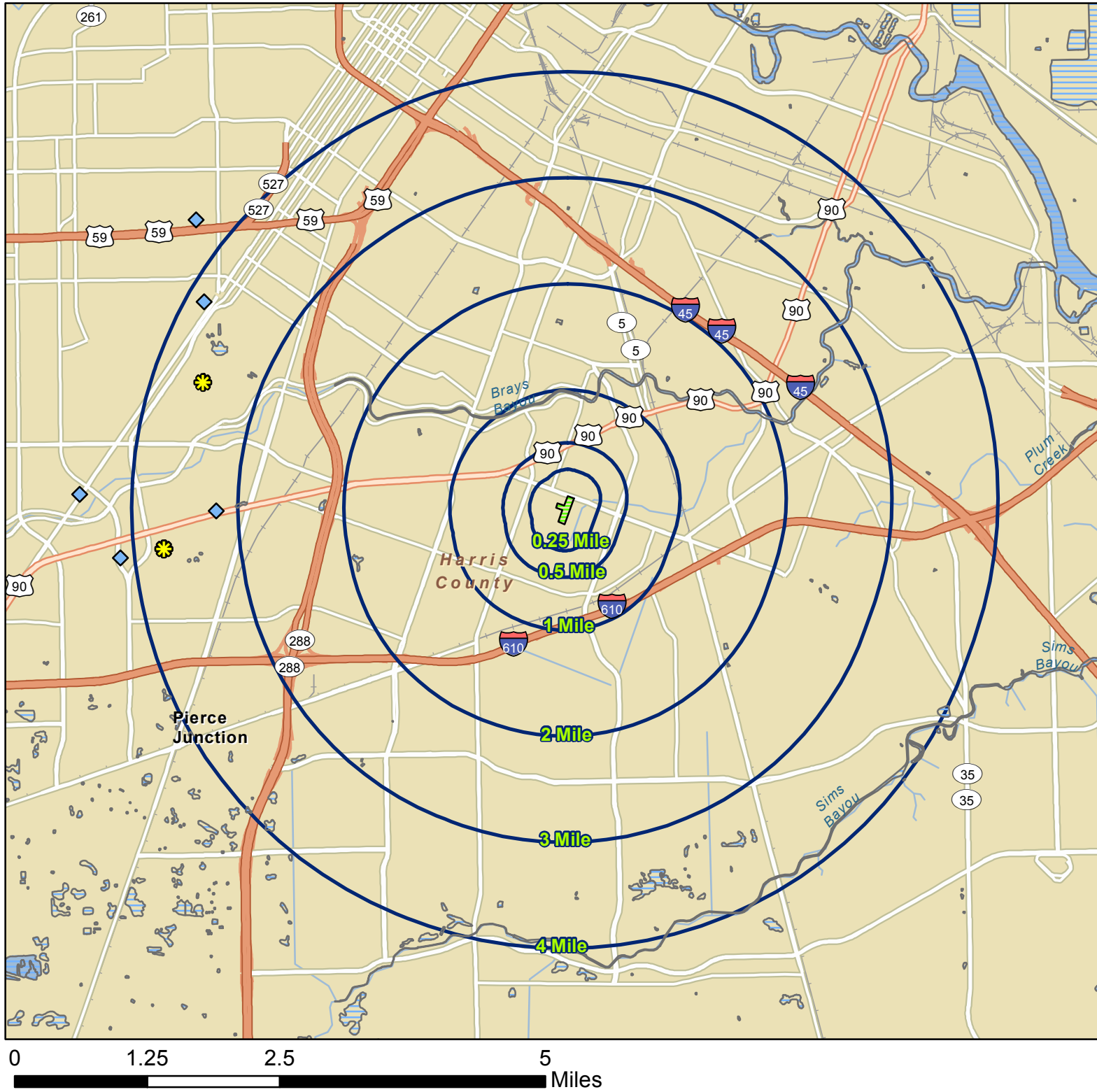
There are 14 residences bordering the site on the east side and three residences bordering the site on the south side (Figure 3). Sources at the site are within 50 feet of several of these residences and the nearest home is located 25 feet south of the site (Figure 2; Ref. 29, p. 3). Since 2005, residents in the area have complained of strong and offensive odors from the site that resulted in nausea, dizziness, and headaches. From October 2005 to February 2009, the City of Houston responded to more than 200 odor and emission complaints from nearby residents, resulting in over 50 notices of violation and nine citations (Ref. 29, p. 6). From February 2009 to September 2011, there were 270 citizen complaints of nuisance odors, and 65 complaints resulted in notices of violation. From September 2011 to July 2014, there were an additional 59 complaints of nuisance odors, one of which resulted in a notice of violation that was issued by the City of Houston on April 16, 2014 (Ref. 28, pp. 4-6, 11-12, 21-37).

The City of Houston Health and Human Services Department analyzed an air sample collected at the site on January 24, 2008. Contamination detected included methylene chloride, acetone, benzene, toluene, ethylbenzene, xylene, and other VOCs (Ref. 40, pp. 1-2). Air samples collected at the site by the EPA on August 6, 2014 also indicated detections of ethylbenzene, benzene, and 1,4-dioxane (Ref. 43, pp. 8-16). During the September 24, 2014 site visit, TCEQ staff noticed strong phenolic odors and other unknown chemical odors emanating from various sources at the site (Ref. 5, pp. 8, 12).

The nearest park, Mac Gregor Park, is located 0.4 miles to the north (Figure 4). The nearest church, Garden of Gethsemane Baptist Church, is located 400 feet northwest of the site across Griggs Road (Figure 3). According to the 2010 census, 11,853 people live within one mile of the site (Ref. 9, p. 5).

3.4.2 Environmental Receptors

Mac Gregor Park is the only designated recreation area present within one mile of the potential sources at the site. There is no commercial agriculture or commercial silviculture present within 0.5 miles of the site (Figure 4). The largest perennial wetland near the site is Brays Bayou, which is 77.9 acres in size and is located approximately 0.75 miles north of the site. Other wetlands located within the 4-mile TDL range in size from 0.10 to 2,385.25 acres (Ref. 26, pp. 1-4).



**Figure 4: 4-Mile
TDL Map**
CES Environmental
Services

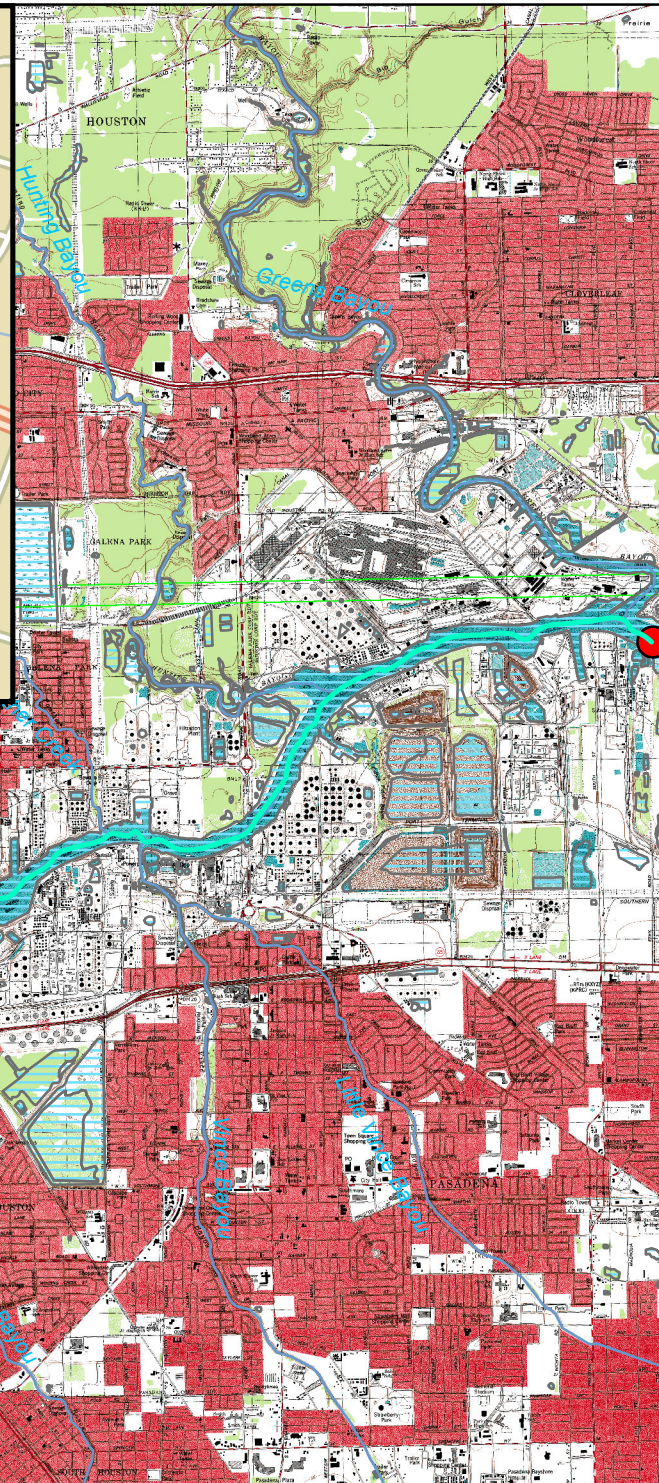
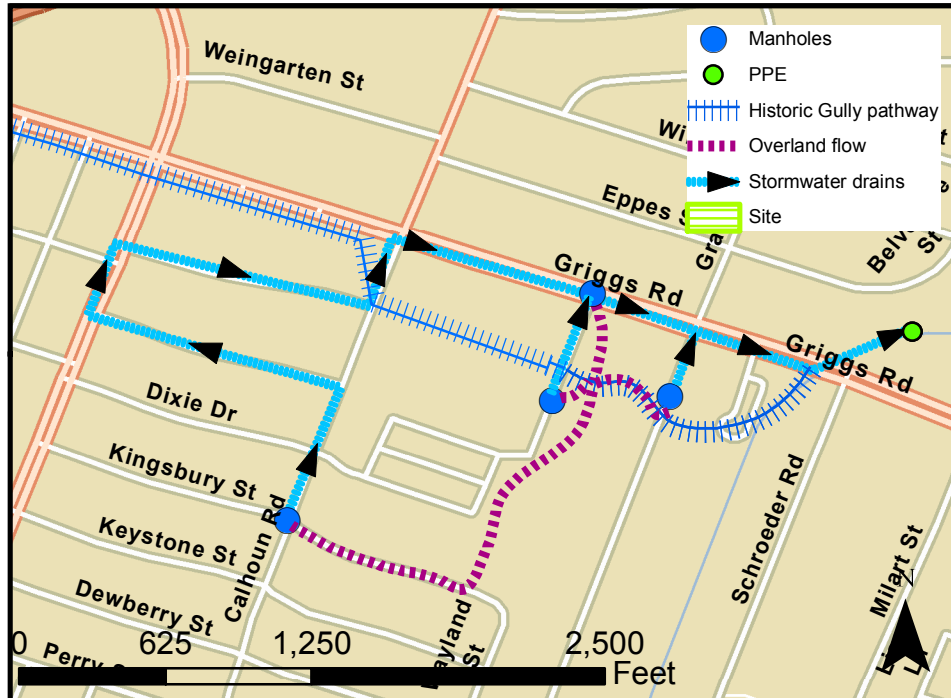
4904 Griggs Road
Houston, Harris
County, Texas



- Domestic Wells
- PWS Wells
- Distance rings
- Wetlands
- Site Boundary

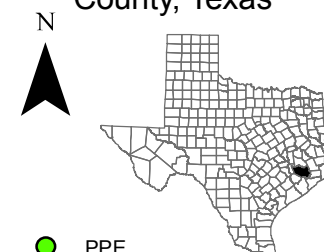


The base map is ESRI USA Street Map. Coordinate System: NAD 1983 UTM Zone 15N. The wetlands layer is from the National Wetlands Inventory. This map was generated by the Remediation Division of the Texas Commission on Environmental Quality. It is intended for illustrative or informational purposes only, and is not suitable for legal, engineering, or survey purposes. This map does not represent an on-the-ground survey conducted by or under the supervision of a registered professional land surveyor. In cases where property boundaries are shown, it only represents their approximate relative location. No claims are made to the accuracy or completeness of the data or to its suitability for a particular use. For more information concerning this map, contact the Remediation Division at 800-633-9363. Map created by Adrienne Love in October 2014.



**Figure 5: 15-Mile
TDL Map**
CES Environmental
Services

4904 Griggs Road
Houston, Harris
County, Texas



- PPE
- Site
- General Overland Flow
- Surface Water TDL
- Wetlands
- End of TDL

The base maps are a Digital Raster Graphic topographic map and an ESRI Street Map layer. Coordinate System of the DRG: NAD 1983 UTM Zone 15N. Coordinate System of the Street Map: WGS 1984. The wetlands layer is from the National Wetlands Inventory. This map was generated by the Remediation Division of the Texas Commission on Environmental Quality. It is intended for illustrative or informational purposes only, and is not suitable for legal, engineering, or survey purposes. This map does not represent an on-the-ground survey conducted by or under the supervision of a registered professional land surveyor. In cases where property boundaries are shown, it only represents their approximate relative location. No claims are made to the accuracy or completeness of the data or to its suitability for a particular use. For more information concerning this map, contact the Remediation Division at 800-633-9363. Map created by Adrienne Love in October 2014.

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